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COMPARISON OF TWO SAMPLING METHODS FOR *LEPTOTHRIPS MALI*[1] IN VIRGINIA APPLE ORCHARDS

M. P. Parrella,[2] J. P. McCaffrey and R. L. Horsburgh

Abstract.—A destructive and time-consuming limb-tap sampling method was demonstrated to be 88% efficient for capturing adult and 2nd larval stage *Leptothrips mali.* This sampling method was compared to a simple, non-destructive, but inefficient, visual sampling technique through regression analysis. A significant relationship was found which indicated that the visual technique may be a practical sampling method.

Predaceous thrips have been sampled from deciduous fruit trees by tapping limbs over a cloth covered tray (Putnam 1965; Parent 1967; Horsburgh and Asquith 1968; Holdsworth 1968) and by visual examination of the foliage for timed periods (Clancy and Pollard 1952). Problems associated with the limb-tap method are the amount of time required, damaged limbs and dislodged fruit. Visual searching of the foliage for *Leptothrips mali* (Fitch) is practical because the adults are black and 2nd larval stages are reddish-brown which allows these stages to be observed against the green foliage. Unfortunately, this technique greatly underestimates the thrips' population on the tree because these predators are not always on the leaves where they can be observed.

To circumvent these problems, the efficiency of the limb-tap technique for capturing thrips was evaluated and regression analysis was employed to determine the relationship between thrips' numbers obtained utilizing a visual search and the limb-tap technique.

Materials and Methods

The efficiency of the limb-tap technique for sampling adult and 2nd larval stage *L. mali* was evaluated in 1977. An abandoned orchard which had not been sprayed for ca. 10 years was used as the study area. Several cultivars were present in the 3.2 ha orchard but Golden Delicious was the only cultivar sampled; trees were 15 years old and ca. 4 m in height. Eight trees were arbitrarily chosen within the orchard and three limbs (ca. 3.2 m high) were selected from the northern, western and southeastern sectors of each

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[1] Thysanoptera: Phlaeothripidae.

[2] Present address: Dept. of Entomology, University of California, Riverside, CA 92521.

Table 1. Efficiency of the limb-tap method for dislodging *Leptothrips mali*.

Tree no.*	Mean numbers of *L. mali***								
	Dislodged			Remaining			Percent capture***		
	19-V	2-VI	21-VI	19-V	2-VI	21-V	19-V	2-VI	21-V
1	22	32	28	2	7	3	91.6	82.0	90.3
2	25	36	37	2	6	1	92.6	85.7	97.4
3	9	57	71	1	10	2	90.0	85.0	97.3
4	14	31	49	0	7	2	100.0	81.6	96.1
5	3	42	27	0	8	4	100.0	84.0	87.1
6	2	48	15	0	6	3	100.0	88.9	83.3
7	14	32	5	2	3	0	87.5	91.4	100.0
8	8	21	24	0	1	4	100.0	95.5	85.7

* 3 limbs per tree were tapped for thrips and subsequently examined in the lab for remaining thrips.

** Means from 3 limbs per tree.

*** No. dislodged ÷ no. dislodged + no. remaining.

tree. The outer meter of each limb was tapped (five taps per limb) with a rubber-coated stick over a 1 m^2 muslin cloth-covered tray. The tray was searched for about 15 min. and the number of thrips dislodged per limb was counted. Immediately after tapping, each limb was covered with a polyethylene bag, clipped, and taken to the laboratory. The limb and bag were carefully examined for remaining thrips within 48 h. Sampling was on three dates; separate trees were sampled only once.

In 1978 this study area was used to determine the relationship between the numbers of thrips counted while visually searching the foliage and the numbers obtained when the same foliage was tapped. Thrips were counted visually on Golden Delicious trees while walking around one-half of a tree for 3 min. The natural position of any part of the tree was not disturbed during the inspection. The visually searched area was then tapped with a rubber-coated stick over a 1 m^2 muslin cloth-covered tray. *L. mali* falling on the tray were collected and counted. Sampling was on five dates at 2-week intervals beginning in mid-June. On each sampling date six trees were arbitrarily chosen in the orchard; separate trees were sampled only once.

Regression analysis was calculated using the General Linear Model procedure (Barr et al. 1976) with the limb-tap and visual data as independent and dependent variables, respectively.

Results

The efficiency of the limb-tap technique for capturing adult and 2nd larval stage *L. mali* ranged from 82 to 100% ($\bar{x}$ ± S.D. = 88.7 ± 14.6) (Table 1). The relationship between the mean numbers of *L. mali* obtained in a visual

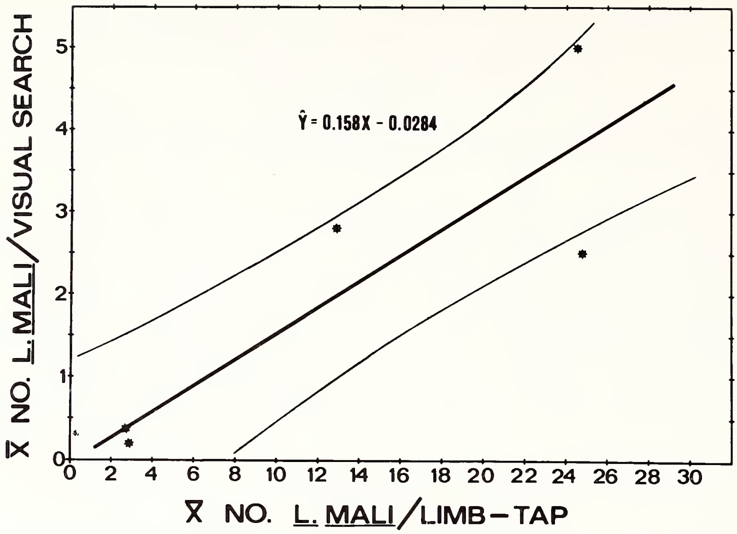

Fig. 1. Relationship between the number of *L. mali* observed and limb-tapped from 6 Golden Delicious trees on 5 sampling dates, 1978 ($R^2 = 0.76$). 95% confidence bands are included.

search and limb-tap is presented in Fig. 1. A significant ($P < 0.05$) R^2 value of 0.76 (based on 5 sampling dates) was obtained indicating that 76% of the variation in the numbers of *L. mali* obtained in the visual search is explained by their linear relationship with the limb-tapped numbers of thrips.

Many factors can affect this relationship including observer efficiency, tree height, cultivar, density of *L. mali* and its prey (mites), environmental conditions, etc. These would have to be taken into consideration and evaluated before the relationship between the limb-tap and visual search can be employed in a sampling program. The visual search is 6 times faster than the limb-tap (3 min. vs 15–20 min.) and may be of use in a study of population dynamics where an arbitrary rather than an optimum sampling plan is acceptable (Morris 1960).

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Department of Entomology, Shenandoah Valley Research Station, Virginia Polytechnic Institute and State University, Steeles Tavern, Virginia 24476.

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